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A Bibliometric Analysis of Digital Business Models: Comparative Insights Before and After COVID-19

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Abstract

Discussions related to digital technology and business models have developed significantly in the last decade, especially since the Covid-19 pandemic as an acceleration momentum in digital business model research. Based on this phenomenon, this study aims to provide a comprehensive overview of the scientific literature landscape related to digital business models using a quantitative approach through bibliometric analysis. Referring to Scopus indexed publications in the last decade, this study will show changes in trends that occurred in the pre- and post-pandemic phases, showing the evolution of research trends, the most influential documents with the highest citation indicators, co-citation networks, co-occurrence patterns, and thematic shifts. Based on the findings of the trend shifts revealed through this approach, this study recommends a future agenda for the context of digitalization of business models to focus on three strategic things, namely sustainability and circular economy, digital transformation strategy, and technology-driven innovation.

Keywords: Bibliometric, Business Model, Covid-19, Digitalization, Digital Technology

1. Introduction

In a company, a business model has a vital role in describing an effective process so that the business can achieve maximum performance. A business model is defined as a business process architecture from creating, delivering, to capturing value from customers [1]. Based on this definition, a business model is used as a mechanism to convert value propositions into profits. The important role of a business model lies in its ability to connect technological innovation, asset utilization (both tangible and intangible), and the right strategy to produce financial performance that allows the business to grow sustainably [2]. Due to its very important role, the design and implementation of a business model greatly influences the business's ability to be adaptive and agile in responding to various external challenges and continuing to develop internal factors as truly useful assets. A good business model should ideally be flexible, innovative, and

supported by the dynamic capabilities of the business organization, so that the company can continue to survive and win the competition [3].

In the digital era, businesses are required to evolve in order to be the best in meeting rapidly changing consumer desires. The digital era is indicated by the very rapid advancement of digital technology, which fundamentally changes the way businesses operate and interact with customers [4], [5]. The digital era also refers to a situation where digital technologies such as the internet, artificial intelligence, and the use of big data change the way individuals, businesses, and industries operate, creating a faster, more interconnected, and data-driven business landscape in decision making [6], [7]. This era has a significant impact on business management, including the transition from traditional business models to the evolution of digital platform-based business models due to changes in consumer behavior that cannot be separated from digital technology in meeting needs [8], [9]. Businesses must transform by adopting the right digital technology, developing more flexible business models, and strengthening strategies in facing competition [10]. The business competition landscape in the digital era is changing very quickly and uncertainly, where companies are not only competing in terms of services and products, but also in a more comprehensive digital ecosystem.

However, digital transformation in business models also has a downside, data shows that the failure rate in digital transformation in business models reaches 66% to 87.5%, this is a signal that many companies do not have the right process in facing the challenges of digitalization [6]. Previous research shows that the failure of digitalization in business is caused by a lack of mature strategy, mistakes in selecting and implementing digital technology, and internal resistance to change [11]. Another factor that causes failure in implementing digital technology in business models is a lack of understanding of the value that will be created through digitalization, so that the implementation of technology cannot be aligned with the business model. In the process of implementing digital technology in business models, companies often fail to develop dynamic capabilities, adjust business strategies, and build an integrated digital ecosystem [12]. In addition, company leaders experience a dilemma in adopting the right digital technology that has been proven to improve business performance.

In addition to the dilemma of the demands of transformation and the high rate of failure of digital transformation in business models, a pandemic has increasingly driven extreme changes in consumer behavior regarding connections with various digital services [13]. Based on the high rate of failure of digital transformation in business models, it is a strong signal for research to reveal an in-depth discussion of successful digital transformation. The need to understand digital transformation due to changing eras is very urgent, especially the disclosure of digital transformation in business models before and after Covid 19. Findings from previous studies do show that there are several discussions related to digital transformation in business models, but there are still few studies that reveal the shift in focus on this topic in the time span before and after the pandemic. So it is important to compile further research to reveal the focus points and research trends before and after the pandemic, so that it can be useful for stakeholders as a basis for adapting the right business model strategy.

This study uses a quantitative approach with bibliometric methods to provide an in-depth understanding and overcome the limitations of subjective assessment of previous studies [14], [15]. This study will fill the knowledge gap on changes in the discussion of digitalization of business models which will be revealed through publication growth, the most influential documents seen from the number of citations, and reveal important keywords in the period before and after the pandemic to show changes in factors that influence the success of business models in the digital era. This study will reveal the visualization of the discussion of digital transformation and business models by answering the following questions:

RQ1: What changes have occurred in the trend of research on digital technology and business models as seen from publication sources, the most productive researchers, documents with the highest citations, and publication productivity based on time span?

RQ2: How have keywords changed for research on digital technology and business models before and after the pandemic?

RQ3: What can be learned from the shift in the topic of digital technology and business models before and after the pandemic?

This study contributes to the discussion topic of digital transformation on business models through three processes. First, a detailed discussion of publication trends will be compiled based on an analysis of publication sources, influential researchers, documents with the highest number of citations, and an overview of publication productivity based on time span. Second, this study will discuss co-citation to explore influential sources and references, and co-occurrences to reveal interrelated research themes. Finally, this study will discuss future research agendas at the individual and organizational levels. Through these three processes, this study contributes to a deep and comprehensive understanding of the shift in the discussion of digital technology and business models, provides important insights, and offers a future agenda for stakeholders.

2. Literature Review

The previous research used as a basis for discussing this research is related to business models and the role of digital technology in business models.

2.1 Business Model

Business models play an important role as a competitive advantage for companies, especially in facing increasingly tight competition in the digital era full of disruption and uncertainty [16]. A business model is defined as a framework that explains how a company creates, delivers, and captures value, and how the company interacts with customers, partners, and other stakeholders [1]. Previous research shows that an innovative business model can provide significant differentiation compared to competitors, allowing companies to remain relevant and adaptive to the dynamics of the ever-changing market [5], [9].

In facing competitive conditions in the digital era, business models should not only be oriented towards short-term economic benefits, but must also have flexible capabilities so that they can make the business survive in the long term. Recent research highlights that companies that succeed in surviving in a business environment with tight competition are business organizations that are able to develop more than one business model to manage risks and capture new opportunities [17]. In addition, the concept of internal capabilities is also an important aspect in considering the creation of a business model because internal conditions that have dynamic capabilities can enable business organizations to continue to adjust strategies based on external changes and technological developments in the digital era [18]. In addition, the current business model is also increasingly developing by integrating digital technology and sustainability values, where companies are not only oriented towards profitability but also consider social and environmental aspects as long-term values [19]. Based on various previous studies, it is important to explore further research on adaptive business models to provide insight for business organizations in building more resilient and sustainable strategies in the current era of digital disruption.

2.2 Role of Digitalization in Business Model

In today's era, digital technology has played a crucial role in transforming business models by enabling companies to create, deliver, and capture value more efficiently and adaptively [20]. Digitalization not only plays a role in accelerating product and service innovation but also creates opportunities for new business models that are more flexible, data-driven, and utilize platform models. Previous research shows that the adoption of digital technology allows companies to increase connectivity with customers and business

partner networks, facilitate transactions through a digital platform approach, and optimize transactions with artificial intelligence, blockchain, and big data-based technologies [21]. In addition, digitalization also plays a role in supporting sustainable business models and encouraging resource efficiency, minimizing environmental impacts, and increasing economic inclusiveness by creating wider access to global markets [22].

In the context of business, digitalization is a fundamental element that cannot be avoided in today's digital era. Digitalization can enable companies to develop more resilient and responsive business models for the market. Research shows that the success of digital transformation in business models is highly dependent on the company's ability to integrate technology with a strong strategy, including the use of dynamic capabilities to adjust business operations to changes in technology and market trends [23]. Digital technology-based business models enable companies to explore new revenue sources, reduce operational costs, and create more personalized customer experiences through data analytics and artificial intelligence. In addition, digitalization opens opportunities for businesses to build a broader value ecosystem through collaboration with various stakeholders, both locally and globally. Although previous studies have shown the important role of implementing digital technology in business models, there are still various obstacles to its successful implementation, especially in terms of organizational readiness, appropriate technology investment, and changes in work culture in adopting digital ecosystems effectively [24].

Based on the literature on the importance of implementing the right digital technology in the business model, it is important to conduct further research on the integration of the right digital technology in the business model. This can provide important insights for business organizations to be able to optimize the right digital transformation strategy to achieve long-term sustainability and competitiveness.

3. Research Methodology

To maintain the quality of the analysis results, the following will explain the methodology used in this study.

3.1 Data Source

This study uses previous research data in exploring the characteristics of literature on digital technology research topics in business models before and after the Covid 19 pandemic. The publication data used are Scopus-indexed scientific publications to ensure the reputation of the documents to be reviewed [25]. Data mining in this study uses Title-Abs-Key as the main query with the keywords "Digital Tech*" OR "Digital Transfor*" and "Business Model". Data extraction was carried out in February 2025 with two data retrievals, namely the pre-Covid period with a range of 2010 to 2019, and the post-Covid publication period, namely from 2020 to 2025. Limitations were made to ensure data quality, namely with the subject areas "business, management, accounting", "social science", "economics, econometrics, and finance", and "computer science". Furthermore, document types were also limited to journals and conference proceedings in English. Based on these criteria, 984 publication documents were found, of which 205 were pre-pandemic documents with a time span of 2010 to 2019 and 779 post-pandemic documents with a time span of 2020 to 2025. The data extraction process in Scopus uses the Wu *et al* (2024) method and is presented in Figure 1 [6]:

3.2 Bibliometric Analysis

This study uses Biblioshiny to visualize the evolution in the knowledge domain, identify citations in previous studies, and cluster co-citations that will be shown in the knowledge map. Through the Biblioshiny analysis tool, this study processes publication information into scientific knowledge that reveals changes in research on the topic of digital technology and business models, publication sources, research productivity, and documents with the highest citations to answer RQ 1. Furthermore, co-citation and co-occurrence analysis and cluster analysis are also carried out to identify changes that occur in the core keywords on the topic of

digital technology and business models research, thus answering RQ 2. Based on this analysis, this study will describe recommendations for future agendas that are viewed from individual, organizational, and ecosystem aspects comprehensively.
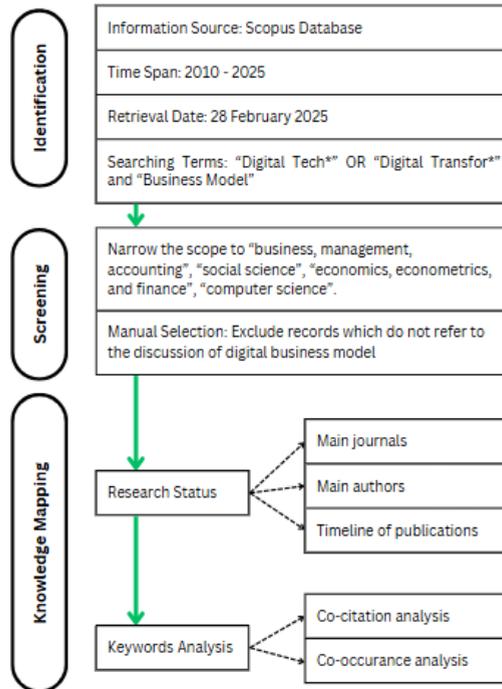
Figure 1. Diagram of the Employed Methodology

4. Results and Discussion

4.1 Summary Statistics

Figure 2. Summary Statistics Before and After the Pandemic

The analysis results (in Figure 2) for publications on the topic of digital technology and business models in the period 2010–2019 show a growing research trend with 205 documents published in 164 sources, experiencing an annual growth rate of 33.9%. Research on this topic involves 507 authors, and an average of 2.77 collaborators per document, indicating a tendency towards team-based research. International collaboration in research reached 21.95%, indicating that research in this domain is cross-country and multidisciplinary. Found 711 keywords; this study shows a broad scope of themes. The number of references of 8,830 reflects a strong academic foundation. The average age of the document is 7.77 years, indicating

that this research is still based on relatively new and developing literature. In addition, the academic impact of this topic tends to be high, with 38.97 citations per document. This indicates that research on digital technology and business models is an influential area of study in business strategy in the digital era, in the period before the pandemic.

Furthermore, the analysis of post-pandemic publications has increased very rapidly compared to the period 2010–2019. There are 779 documents in 458 sources, which is three times the number of previous publications. International collaboration increased significantly from 21.95% to 29.91%, and the average number of authors per document increased from 2.77 to 3.26, indicating that post-pandemic research is increasingly complex and multidisciplinary. The number of references increased drastically from 8,830 to 43,590, while the average age of cited documents decreased from 7.77 years to 2.59 years, indicating that current research is based on the latest literature due to the rapidly changing situation. However, the academic impact of this topic has decreased, with the average citation per document decreasing from 38.97 to 21.78, reflecting a shift in research dynamics, where digital technology in post-pandemic business models is relatively in the process of exploring and adapting to new realities that are developing very quickly and indicating strong uncertainty in the situation.

4.2 Performance Analysis

To answer RQ1, a discussion will be conducted on the analysis of the main journals, researcher productivity, highly cited documents, and publication productivity in the period before and after the pandemic. Data in Figure 3 shows the situation before the pandemic, publications were spread across various conferences and journals, with the ACM International Conference Proceeding Series as the main source (6 documents), followed by Sustainability (Switzerland), Technological Forecasting and Social Change, and Proceedings of the 33rd International Business INF with 5 documents each. Publications tend to focus on business model innovation and information technology in conventional business environments. However, after the pandemic, the number of publications increased drastically, with Sustainability (Switzerland) dominating with 52 documents, indicating a shift in research focus to sustainability aspects in digital business models. Journals such as Technological Forecasting and Social Change (25 documents), as well as conferences such as the ACM International Conference Proceedings Series (12 documents) and Springer Proceedings in Business and Economics (12 documents) are increasingly relevant. In addition, the emergence of IEEE Transactions on Engineering Management (11 documents) and Journal of Business Research (9 documents) indicate that post-pandemic, research is not only focused on digitalization, but also on business strategy, sustainability, and innovation management in a broader context. The increasing number of publications in sustainability and business strategy journals indicates that post-pandemic digital business models emphasize not only technological efficiency, but also adaptability and long-term impact in the face of global uncertainty. A summary of publication sources as an indication of the shift in focus is presented in Table 1.
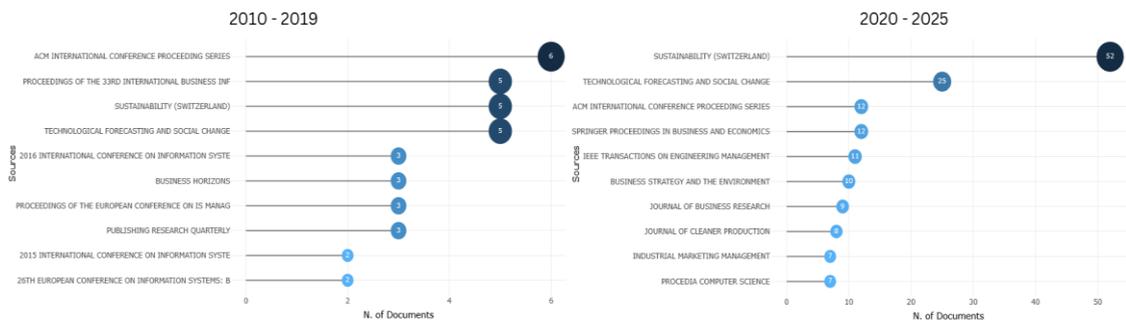
Figure 3. Most Relevant Sources

Table 1. Discussion Focus Based on Publication Sources

Aspect	Before Pandemic (2010 - 2019)	Post-Pandemic (2020 - 2025)
Main Publication Source	ACM International Conference Proceeding Series	Sustainability (Switzerland)
Highest Number of Documents	6 Documents	52 Documents
Research Focus	Innovation in business models and digital technologies	Sustainability in digital business models
Publication Dominance	Spread across various conferences and journals	Dominated by Sustainability journals and business strategy-based journals
Trend Changes	Focus on digital innovation in business models	Focus on adaptability and sustainability in digital business

4.3 Performance Analysis

Before the COVID-19 pandemic (2010-2019), based on Figure 4, research related to digital technology and business models was dominated by a number of academics with a fairly high level of productivity. Mark de Reuver, Elidjen, and Leonardus W. W. Mihardjo were the most productive researchers in this period with 5 publications, followed by Firdaus Alamsjah, Lutz M. Kolbe, and Sasmoko, who each had 4 publications. In addition, several other researchers, such as Andre Hanelt, Maximilian Röglinger, and Harry Bouwman, also showed significant contributions with 3 publications. In terms of academic impact, these studies experienced a significant increase in the number of citations, especially towards the end of the decade. For example, Firdaus Alamsjah had 2 publications in 2018 with a total of 25 citations, which increased to 30 citations in 2019 with a total of 4 publications, indicating that research in this field is getting more attention in the academic community.
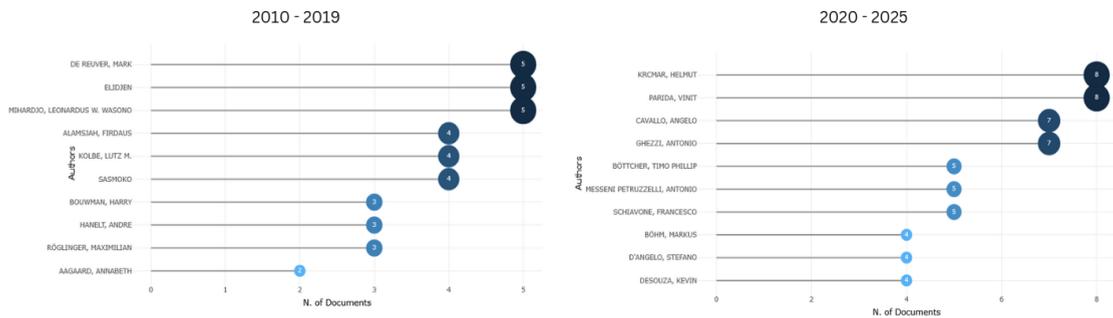
Figure 4. Researcher Relevance Based on Publication Documents

However, after the COVID-19 pandemic (2020-2025), there has been a significant shift in the research landscape with the emergence of new, more productive academics in the field. Helmut Krcmar and Vinit Parida are the researchers with the highest number of publications, each publishing 8 papers, followed by Angelo Cavallo and Antonio Ghezzi with 7 publications. In addition, Antonio Messeni Petruzzelli, Timo Phillip Böttcher, and Francesco Schiavone also recorded high productivity with 5 publications. In terms of impact, post-pandemic research shows a different citation pattern, with some articles experiencing a large spike in citations in a short period of time. For example, Markus Böhm had 2 publications in 2020 but only gained significant impact in 2023 with 92 citations with a total of 4 published papers, indicating that post-pandemic research is gaining greater relevance as the adoption of digital technologies accelerates. This indicates that post-pandemic research is not only focusing on the conceptual aspects of digital transformation but also on strategic implementation and practical impacts on global business and the economy.
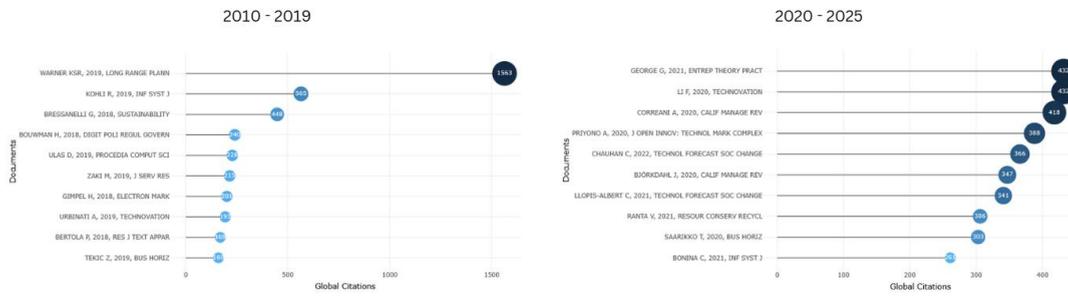
Figure 5. Global Level Citation

Before the pandemic (2010-2019), based on Figure 5, the most cited article was Warner KSR's (2019) publication in Long Range Planning with 1,563 citations, indicating that pre-pandemic research was heavily influenced by the concept of long-term strategic planning in the face of digital transformation. Other articles, such as Kohli R (2019) in Information Systems Journal with 565 citations and Bressanelli G (2018) in Sustainability with 448 citations, also showed a focus on aspects of digital technology and business sustainability. However, after the pandemic (2020-2025), there was a change in the citation pattern, where no single document dominated with the number of citations above 1,000. The documents with the highest citations were George G (2021) in Entrepreneurship Theory and Practice and Li F (2020) in Technovation, each with 432 citations, followed by Correnani A (2020) in California Management Review with 418 citations. This change shows that after the pandemic, research in the field of digital technology and business models is more fragmented. In addition, the increase in the number of citations for articles that are more oriented towards technology implementation, such as Priyono A (2020) in the Journal of Open Innovation with 388 citations, indicates that after the pandemic, academic focus is more directed at the real impact of digital transformation on business models. This confirms that the shift from theory to practice is getting stronger, where post-pandemic studies examine more how digital technology is applied directly to increase business competitiveness and sustainability in the face of global uncertainty.
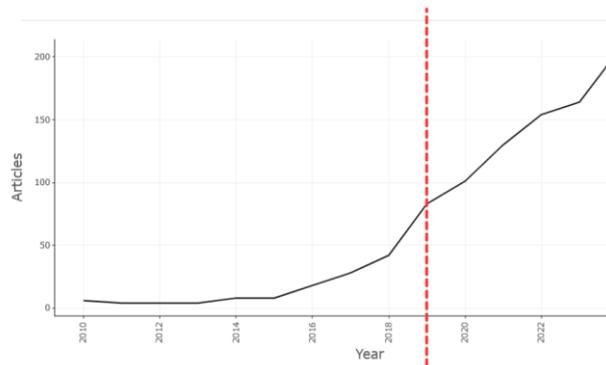
Figure 6. Publication Productivity 2010 – 2025

Before the COVID-19 pandemic (2010-2019), based on Figure 6, the highest number of publications occurred in 2019, with 83 articles, reflecting the increasing interest of academics in the adoption of digital technology in business models before the pandemic. Overall, there were 205 publications during this period, indicating that research in this field is still in the conceptual development stage and early exploration of the impact of digitalization on business strategy and innovation. This increase can also be attributed to the development of digital platforms and technology ecosystems that drive changes in various industries. However, after the pandemic (2020-2025), there was a drastic increase, and there are several important

factors to discuss, such as a change in the direction of more specific research and a shift in academic focus to more applicable studies as shown through 779 published documents. The pandemic has proven to be a momentum to accelerate discussions related to digital technology and business models among various stakeholders.

4.4 Co-Citation Analysis

The discussion of RQ2 is carried out by revealing co-citation to map intellectual relationships in a research field and identify citation patterns that describe the developing discussion topics. Co-citation network analysis (the data shown in Figure 7) in the period 2010–2019 shows a more concentrated structure with the dominance of several main references such as Teece (2010), Osterwalder (2010, 2011), and Bharadwaj (2013). This network has a more linear relationship and is concentrated on the theory of competitive advantage-based business models and digital transformation in a traditional context. This is reinforced by the density visualization, which shows areas of high density around the seminal literature, indicating that research in this period is still focused on established theoretical foundations. The minimal distribution of nodes and low fragmentation in the network indicate that research on digital technology and business models is still in the early exploration stage, with the majority of studies referring to several primary sources without much diversification into broader perspectives.
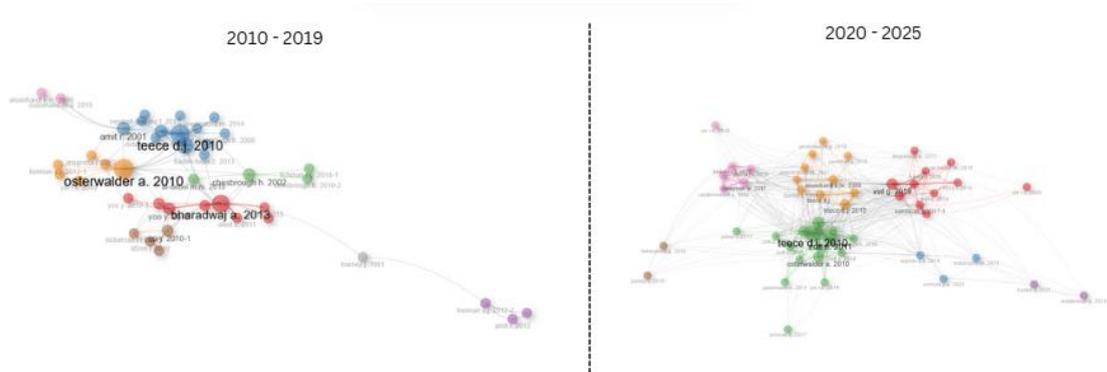
Figure 7. Co-Citation Analysis

In contrast, after the pandemic (2020–2025), the co-citation structure underwent significant changes with a more complex and distributed network. Although Teece (2010) remains one of the key references, a number of new literatures, such as Vial (2019) and Nambisan (2017, 2019), have emerged that have gained a central position in the network, indicating a shift in citation patterns. This is in line with changes in density visualization, where high-density areas are no longer concentrated in one point but are spread to several new points, reflecting diversification in research related to digital technology and business models. The increased distribution of nodes and wider connectivity indicate that post-pandemic research is increasingly multidisciplinary, with explorations of new concepts such as the platform economy, digital ecosystems, and technology-based innovation strategies. Thus, changes in co-citation patterns not only reflect the evolution of academic literature but also reflect fundamental transformations in increasingly dynamic and complex digital business practices in the post-pandemic era.

4.5 Co-Occurrence Analysis

Co-occurrence analysis was conducted to answer RQ2 related to trend changes. This analysis focuses on identifying relationships between concepts in a research field based on keywords in a document. This analysis was conducted to map the conceptual structure of digital technology and business model research

topics (the data is shown in Figure 8). In the period 2010–2019, research related to digital technology and business models focused on fundamental concepts such as business modeling, information systems, and cloud computing, with limited inter-topic linkages. Density visualization shows that citation density is centered on digital technologies, while terms such as big data, cutting-edge technology, and internet of things have begun to emerge but have not been closely integrated. This reflects that the adoption of digital technology in business is still in the conceptual stage, with research oriented more towards the development of traditional business models than disruptive digital transformation.

After the pandemic (2020–2025), the co-occurrence network has become more complex and interconnected, reflecting the acceleration of technology adoption in various aspects of business. Concepts such as blockchain, digital innovations, and electronic commerce are now more integrated, with a wider density of citations, indicating increased diversification and depth of research. The emergence of terms such as COVID-19, technological development, and smart manufacturing suggests that post-pandemic research is focusing more on the impact of technology in the context of business adaptation and industry resilience. This shift indicates that digital business model research has evolved from theoretical exploration to strategic application in more dynamic and future-oriented digital ecosystems.
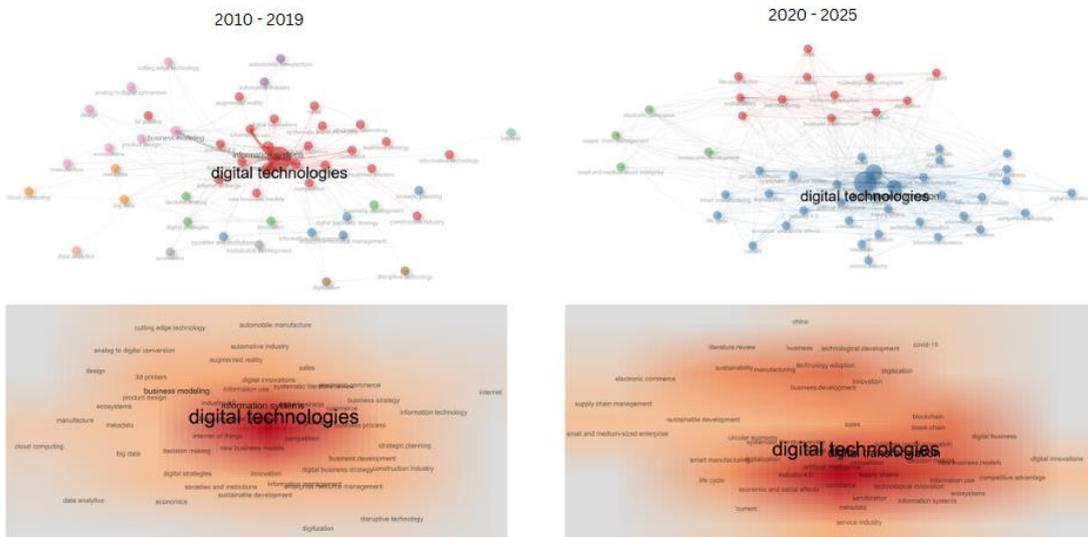

Figure 8. Co-Occurrence and Density Analysis

### 4.6 Conceptual Structure Analysis
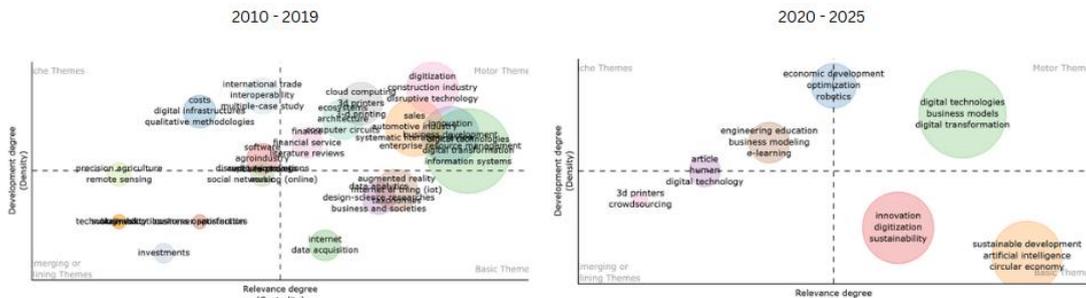
Figure 9. Thematic Analysis

4.6.1 Thematic Analysis Before the Pandemic

Thematic map analysis for the period 2010–2019 in Figure 9 shows that research related to digital technology and business models is still in the early exploration stage, with several main themes dominating. Motor themes, which have high relevance and level of development, are dominated by digitization, cloud computing, disruptive technology, enterprise information systems, and information systems. These themes are the main drivers of research because they play a role in digital transformation in various industrial sectors. Meanwhile, basic themes, which have high relevance but have not been developed in depth, include the internet, data acquisition, augmented reality, and the internet of things (IoT). These themes are the basis for digital business model studies, although their application is still in the early stages.

On the other hand, several niche themes are in the niche themes category, which have a high level of development but are less relevant in the broader research ecosystem. Topics such as international trade, interoperability, digital infrastructure, and qualitative methodologies are developing in a more specific scope, but have not yet become the main focus in digital business models. On the other hand, themes that fall into the category of emerging or declining themes, such as precision agriculture, remote sensing, investments, and social networking (online), are starting to experience a decline in relevance in the context of digital business transformation. This shift shows that before the pandemic, research focused more on the integration of digital technology into business models conceptually, but had not yet widely explored its strategic implementation in a more complex and dynamic business ecosystem.

4.6.2 Thematic Analysis After Pandemic

The thematic map analysis for the 2020–2025 period in Figure 9 shows a significant shift in digital technology and business models research, with the increasingly strong role of digital transformation in shaping modern business strategies. Motor themes, which have high centrality and density, are dominated by digital technologies, business models, and digital transformation, reflecting that digital technology has become the core of business innovation. Meanwhile, basic themes, with high centrality but lower density, include sustainable development, artificial intelligence, and circular economy, indicating that sustainability and AI are starting to become the main foundation in the development of future business models, especially in facing global challenges such as resource efficiency and the digital-based economy.

On the other hand, niche themes such as economic development, optimization, and robotics are developing as topics with high density but lower centrality, indicating in-depth exploration of the economic impact and efficiency of digital-based businesses, although their influence on the broader research ecosystem is still limited. Meanwhile, emerging themes, which include 3D printers, crowdsourcing, and digital technology in the context of articles and human studies, indicate that these topics are developing and have the potential to become more central in the future. This shift reflects that post-pandemic, research has evolved from mere technology exploration towards strategic application in more sustainable, integrated, and comprehensive digital innovation-based business models.

4.7 Future Research Agenda

Referring to previous research documents post-pandemic with the highest citations at the global level, important information was obtained that can be used as a basis for future agendas. The summary of previous research findings as a basis for future research agendas can be seen in Table 2.

Based on the findings of highly cited research in the post-pandemic period, keyword analysis and clustering were conducted for future research agendas. The findings are presented in Figure 10.

Table 2. Post-Pandemic Research with High Citations

| Research Title	Researchers	Research Findings	Research Limitations
Digital Sustainability and Entrepreneurship: How Digital Innovations Are Helping Tackle Climate Change and Sustainable Development	Gerard George, Ryan K. Merrill, Simon J.D. Schillebeeckx	Digital innovations empower entrepreneurial responses to climate change and sustainability through scalable, trust-based digital solutions.	Lack of empirical research on the real impact of digital sustainability on business models.
Linking Circular Economy and Digitalisation Technologies: A Systematic Literature Review of Past Achievements and Future Promises	Chetna Chauhan, Vinit Parida, Amandeep Dhir	IoT and AI play central roles in enabling a circular economy, supported by product-service systems and digital transformation.	The literature is still fragmented, lacking cross-disciplinary integration, and lacking exploration of sectoral challenges.
Identifying Digital Transformation Paths in the Business Model of SMEs during the COVID-19 Pandemic	Anjar Priyono, Abdul Moin, Vera Nur Aini Oktaviani Putri	SMEs respond to COVID-19 through varied digital transformation paths based on digital maturity, social capital, and financial strength.	Generalization is limited because the study was qualitative and only included seven companies.
Impact of Digital Transformation on the Automotive Industry	Carlos Llopis-Albert, Francisco Rubio, Francisco Valero	Digital transformation boosts productivity, competitiveness, and customer value in the automotive sector, reshaping business models and industry structures.	The focus is limited to the automotive industry in Spain, without covering the global context and other market dynamics.
Digital Technologies Catalyzing Business Model Innovation for Circular Economy—Multiple Case Study	Valtteri Ranta, Leena Aarikka-Stenroos, Juha-Matti Väisänen	Digital technologies catalyze both incremental and radical circular business model innovations, enhancing resource efficiency and value capture.	Lack of cross-industry empirical studies measuring the impact of digitalization on circular business model innovation.
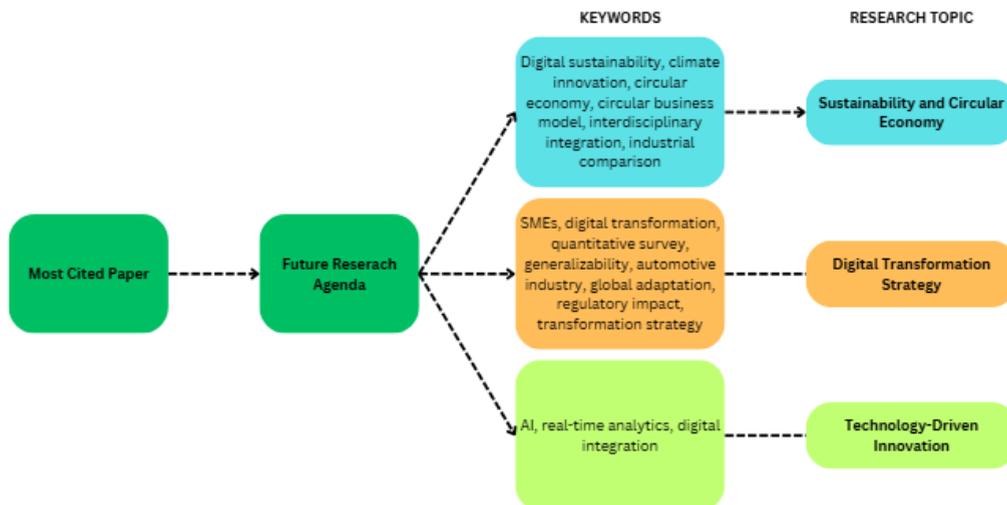
Figure 10. Future Research Agenda

From the figure, the results of keyword clustering show that future research topics in the realm of digital technology and business models are concentrated in three strategic areas, namely Sustainability and Circular

Economy, Digital Transformation Strategy, and Technology-Driven Innovation. The Sustainability and Circular Economy cluster highlights the importance of digital integration in driving innovation of environmentally friendly and sustainable business models, reflecting the response to global demands for climate challenges and the need for resource efficiency in the business scope. Furthermore, the Digital Transformation Strategy cluster covers topics such as the adaptation of SMEs' business strategies in the digital era, digital ecosystem integration strategies at the industry level, to regulatory policies, which emphasize the need for contextual and sectoral understanding in managing digital transformation holistically. Finally, the Technology-Driven Innovation cluster emphasizes the role of technologies such as AI, real-time analytics, and digital integration as key drivers in creating technology-based competitive advantages. These findings indicate that the three clusters not only reflect emerging scientific trends but also open up crucial strategic research spaces for a more adaptive and sustainable business future.

5. Conclusion

Through the bibliometric analysis that has been conducted, this study provides a visualization of the evolution of trends in the topic of digital technology and business models and compares the focus of the discussion on conditions before and after the Covid 19 pandemic. This study contributes to providing important insights for stakeholders related to digitalization in relevant business models by referring to the changes in focus that occurred in the digital era before and after the pandemic. The findings of this study reveal publications that are increasingly directed at the values of sustainability and the practical implementation of digital technology in business models, seen from publication sources, documents with the highest citations, thematic analysis, co-occurrence, and co-citation. This study also presents a future agenda, presented as a conclusion, where there are three strategic clusters that are very relevant for stakeholders to provide deeper focus. The three clusters are Sustainability and Circular Economy, Digital Transformation Strategy, and Technology-Driven Innovation.

Theoretically, this study enriches the discussion on the topic of digital technology and business models, so that the research becomes a reference for the development of digital transformation theory, which is increasingly attracting attention from researchers. On the managerial side, this study emphasizes that agility capabilities in business are very important by showing the rapid changes in digitalization strategies in the digital era. In practice, the results of this study can be used as a basis for digital transformation is not just about adopting technology, but it is necessary to further analyze its impact on the company's financial performance and sustainability.

The limitation of this study is that the data used is only sourced from Scopus, so it is better to explore data sources from the Web of Science. In addition, this study also uses quantitative bibliometric analysis for visualization of the analysis results. Future research can use a quantitative approach with analysis tools such as SEM PLS, to find out more about the causal relationship of each driving and inhibiting factor for digitalization in the company's business model.

5. Acknowledgement

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